

## Claims

### What is claimed:

1. A process for applying a catalyst ink onto a substrate, said process comprising:
  - (a) coating a substrate with a catalyst ink under conditions of controlled humidity and temperature to form a deposited catalyst ink on said substrate, wherein said catalyst ink comprises an electrocatalyst, an ionomer and water;
  - (b) leveling the deposited catalyst ink under conditions of controlled humidity and temperature to form a catalyst-coated substrate; and
  - (c) drying the catalyst-coated substrate at an elevated temperature.
2. The process according to claim 1, wherein said catalyst ink further comprises an organic solvent.
3. The process according to claim 2, wherein said catalyst ink further comprises a surfactant with a pressure between 1 and 600 Pascal.
4. The process according to claim 3, wherein the substrate is selected from the group consisting of a polymer film, an ionomer membrane, a carbon fiber, a carbon cloth, a carbon felt and a paper-type material.
5. The process according to claim 4, wherein said substrate is present in individual sheet or in continuous roll form.
6. The process according to claim 1, wherein the coating occurs in a coating compartment and the leveling occurs in a leveling compartment, and wherein the humidity in the coating compartment is maintained at 60 to 100 % relative humidity and a temperature in the range of 10 to 60°C, and the humidity in the leveling compartment is maintained at 60 to 100% relative humidity and at a temperature in the range of 10 to 60°C.
7. The process according to claim 6, wherein the leveling of the deposited catalyst ink is performed for a period of 1 to 10 minutes.

8. The process according to claim 7, wherein the drying of the catalyst ink is performed at a temperature in the range of 40 to 150°C for 1 to 10 minutes.
9. A device for the application of catalyst inks, said device comprising a coating machine, wherein said coating machine is comprised of:
  - 5 (a) a coating compartment for catalyst ink application; and
  - (b) a leveling compartment for leveling of the catalyst ink,and wherein said device is integrated into a continuous manufacturing line.
10. The device according to claim 9, wherein the coating compartment and the leveling compartment are a single compartment or separate compartments.
- 10 11. A composition comprised of a catalyst-coated membrane, wherein said catalyst-coated membrane is comprised of the catalyst-coated substrate produced according the process of claim 1.
11. A composition comprised of a catalyst-coated gas diffusion substrate, wherein said catalyst-coated gas diffusion substrate is comprised of the catalyst-coated  
15 substrate produced according to the process of claim 1.
12. A composition comprised of a catalyst-coated polymer film wherein said catalyst-coated polymer film is comprised of the catalyst-coated substrate produced according to the process of claim 1.
13. A membrane-electrode-assembly comprising the catalyst-coated membrane of  
20 claim 10.
14. A membrane-electrode-assembly comprising the catalyst-coated gas diffusion substrate of claim 11.
15. A membrane-electrode-assembly comprising the catalyst-coated polymer film of claim 12.
- 25 16. A method of using the membrane-electrode-assembly of claim 14, comprising operating a PEMFC or DMFC fuel stack, wherein said fuel stack is comprised of said membrane-electrode assembly.

17. A method of using the membrane-electrode-assembly of claim 15, comprising  
operating a PEMFC or DMFC fuel stack, wherein said fuel stack is comprised  
of said membrane-electrode assembly
- 5 18. A method of using the membrane-electrode-assembly of claim 16, comprising  
operating a PEMFC or DMFC fuel stack, wherein said fuel stack is comprised  
of said membrane-electrode assembly